Ecocycle

newsletter on life-cycle tools, management and product policy.

Winter/Spring 1996 Issue no. 3

on the inside

2 *Netherlands Product Policy*
3 *Raw Material Database Phase II*
3 *Environmental Performance Index*
4 *Sustainable Production & Consumption*
5 *ISO 14000 Information*
6 *Electronics & LCA*
8 *LCA In Australia*
10 *Taking the Natural Step*
11 *Critical Review in LCA*

editor's column

When recently updating the Royal Melbourne Institute of Technology on Environment Canada's product life-cycle management activities, I found myself reflecting on key questions:

What is the role of government in life cycle management?

How has thinking on life-cycle tools evolved?

In the short time Environment Canada has been involved in LCA activity we have undergone a profound change in our thinking about the utility of this approach to achieving environmental improvement. At first, we viewed LCA as somewhat of a panacea, a comprehensive tool to help address the environmental implications of products, or in our case, packaging. The logic of life-cycle as an approach was very attractive but as with most simple, logical ideas, the implementation of product life-cycle management has proven to be extremely complex.

At Environment Canada we participated in and adopted many of the good works of SETAC and the Canadian Standards Association. But as we thought more about implementing these ideas and experimented with projects to ground truth these approaches, some significant problems emerged:

How can you get the co-operation of all the players in the product life-cycle, not only between each stage of the life-cycle but also within each stage?

How do you amass all that information in a meaningful, user-friendly way?

What do you do about impact assessment, particularly during the consumption and use phase of the life-cycle?

How can one product be scientifically identified as environmentally preferable to another without the possibility of litigation?

These and other problems have me believing that from a public policy perspective we should not focus on full blown LCAs. Rather, we need to build the information chain and in this respect we are taking the lead from the Netherlands and their recent policy document on products and the environment.

In the Dutch model, the role of government is to bring relevant environmental information to the market-place so everyone can make appropriate decisions.

What we are doing, and will hopefully continue to do at Environment Canada, is follow this type of approach and work with the market actors -- the raw material producers, manufacturers, consumers, waste management industry etc. -- to draw out the information they need as a basis for environmental improvement regardless of whether that improvement is based on LCA, environmental profiles, less is best, "green" design, or simple common sense.

I believe this information base will not be built from massive LCAs in major product categories but from small projects, such as our Canadian Raw Material Database (see page 3), which, over time will provide more and more environmental information to the marketplace. To promote and support this work Ecocycle will continue to provide articles on life-cycle related projects and case studies of companies and governments. I would be most interested in hearing and sharing your success stories. See the publisher's message on page 2 for contact information.

chain management policy

SINCE THE NETHERLANDS RELEASED ITS FIRST NATIONAL ENVIRONMENTAL POLICY PLAN in 1989, life-cycle management (or integrated chain management) has been key to the development of integrated approaches to solving environmental problems.

To assess its impact, the Ministry of the Environment recently commissioned a study on state-of-the-art integrated chain management. Study results indicate:

- while methodologies are developed they are not implemented widely; and
- some partial chain management initiatives have started but systematic improvements on a cradle-to-grave basis are rare.

To encourage integrated chain management, the study recommended expanding existing policies and influencing the product chain in four key areas: inputs, products, waste policy, and corporate organization. The study also recommends that government establish a framework for self-regulation. Based on this, the study identifies the following roles for government: the initiator, the consensus builder, the diplomat/coalitionist, the employer of incentives, and the network manager.

And finally, the study raises the question of whether companies will take the step from internal corporate systems of environmental management to the external orientation of integrated chain management. To achieve this, companies need to view integrated chain management as an opportunity; the pressure for this change in perspective would likely come from consumers and government – pressures which are not currently evident. ●

Integrated Chain Management Defined:

Integrated Chain Management is the management of material flows, resulting from chains of social activities, with a view to respecting the environmental utilization of space. It involves a life-cycle approach that considers all environmental aspects of entire substance or product chains, from cradle-to-grave.

from "Perspectives on Integrated Chain Management – Options for Policy" 1995.

publisher's message

Ecocycle is published bi-annually by Environment Canada and delivered free of charge to national and international industry, government and non-government organizations and individuals interested in developments on life-cycle management tools and product policy.

Please forward questions or comments to:
Kevin Brady, Editor or Andie Paynter, Associate Editor
Environment Canada, Hazardous Waste Branch,
Ottawa, Ontario, Canada K1A 0H3.
Phone: 1-819-997-3060
Fax: 1-819-953-6881
Email: kbrady@synapse.net

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Canada

New International LCA Journal

MAKE ROOM for a new international journal dedicated to life-cycle assessment (LCA). The first issue of this new publication from Germany hit the streets in January. The journal covers government activities, case studies and projects, peer reviews, developments in LCA methodology and much more.

To subscribe to the International Journal of Life Cycle Assessment, or for information about submitting a paper or advertising rates, please contact:

International Journal of LCA
Subscription Service,
ecomed publishers
Rudolf-Diesel-Strasse 3,
D-86899 Landsberg, Germany
Tel: +49-81 91-125 500
Fax: +49-81 91-125 600

Phase II of Database is underway

FOLLOWING PHASE I OF A PROJECT TO DEVELOP ENVIRONMENTAL PROFILE DATA FOR A NUMBER OF CANADIAN RAW materials, Environment Canada and the Canadian Standards Association (CSA) are exploring a similar initiative with the energy supply sector.

Environment Canada, the CSA, and a number of raw material producers have nearly completed Phase I of the Canadian Raw Materials Database (CRMD). This voluntary project was launched to provide data to small- and medium-sized companies to encourage them to consider the broader upstream and downstream implications of their products. The data can be used by the raw material producers to benchmark environmental progress or by downstream companies to support environmental improvements in their products.

When completed, the database will provide industry-averaged data on energy and raw materials inputs, and environmental releases of the raw material acquisition and manufacturing stages of the material life-cycle. Raw material industries participating in Phase I include: aluminum, glass, paper, plastics, steel and wood.

The proposed Phase II of the database recognizes that in order to provide comprehensive environmental information to product manufacturers and designers, other raw materials and resources need to be considered. In particular, environmental information from the energy supply industry in needed due to the environmental relevance of energy use throughout the product life-cycle. Accordingly, Environment Canada and the CSA are approaching the energy supply industries to solidify their participation in the CRMD Phase II. As with CRMD Phase I, this project will seek to provide industry developed and critically reviewed environmental profile information.

Phase I of the database is scheduled for completion by Dec., 1996. The methodology for compiling the data has been completed and can be obtained from the Canadian Standards Association (document PLUS 1116).

For more information contact:
Kevin Brady, Waste Prevention Division, Environment Canada,
Tel: 1-819-953-1112
Fax: 1-819-953-6881,
Email kbrady@synapse.net

Too much data? No way to evaluate?

Try the Environmental Performance Index

EXECUTIVES IN A RANGE OF POSITIONS ACROSS COMPANIES ARE BEING HELD ACCOUNTABLE TODAY FOR MEETING ENVIRONMENTAL OBJECTIVES AND showing results. Thus, they are eager to have meaningful information about their environmental progress year-to-year, so they can improve overall performance, correct any shortfalls, and report to senior management on progress toward goals.

In their quest to meet a spectrum of environmental goals and requirements, companies are gathering a large amount of data across a wide range of programs, media and operational processes. Typical measures include: reductions in air pollution, electricity use, and progress on remediation sites.

At first, the data may seem too abundant and too diverse to absorb and analyze well. Some results are up, others down. But what do they all mean as a whole? How do you compare the results?

That's why the Environmental Performance Index was developed by Nortel and Arthur D. Little, Inc. for Nortel's use, with the intention that it would be adapted and modified by other companies around the world for their use. Nortel's index manual is available through the internet on the Nortel Habitat page at http://www.nortel.com/habitat.html

An Environmental Performance Index is one way to distill the data into an environmental "score" composed of relatively few, meaningful numbers. Essentially, the

continued on page 7

sustainable production and consumption

policy buzzword or new reality?

WHEN THE 1992 EARTH SUMMIT CONCLUDED, THE WORLD WAS CHALLENGED TO REDUCE AND ELIMINATE UNSUSTAINABLE PATTERNS OF PRODUCTION AND CONSUMPTION. Since this United Nation's Conference on Environment and Development (UNCED), much effort has gone into defining sustainable consumption and production, and into identifying tools and policy measures to help governments and industry respond to this challenge (see chronology).

A recent report entitled *OECD Workshop on Sustainable Consumption and Production: Clarifying the Concepts*, highlights a number of noteworthy activities in this area.

1. The OECD (Organization for Economic Co-operation and Development) work program on sustainable production and consumption involves three elements: clarifying the conceptual framework; identifying policy options and tools; and monitoring and evaluating progress. Key concepts include: eco-efficiency, carrying capacity, natural resource accounting/ green GDP, steady state economy, ecospace and ecological footprint.
2. The United Nations Commission on Sustainable Development (UNCSD) has adopted a work program on changing consumption and production patterns that:
   a) develops long-term projections relating social and economic development trends to consumption and production patterns and environmental impacts;
   b) compares social, economic and regulatory policy instruments for achieving change;
   c) examines the impacts of changes in consumption and production in industrialized countries on development in poorer countries;
   d) works with national

continued on page 5

Changing Consumption and Production Patterns - Selected Chronology

1992	UNCED Earth Summit challenges countries to achieve more sustainable consumption.
Jun. 7-9, 1993	OECD Council Ministerial Meeting, Paris, mandated the Organization to assess production and consumption patterns and sustainable development.
Jan. 19-20, 1994	Symposium on Sustainable Consumption, Oslo, focused on Agenda 21, Chapter 4, for input to 1994 UNCSD.
Oct. 12-14, 1994	UNEP Seminar on Clean Products, Warsaw, included workshop on sustainable consumption and production.
Nov. 3 - Dec. 2, 1994	UNCSD/Korea Environmental Technology Research Institute (KETRI) Workshop on Environmentally-Sound Technologies.
Dec. 18-20, 1994	OECD/Massachusetts Institute of Technology (MIT) Experts' Workshop on Sustainable Consumption and Production, Boston.
Feb. 6-10, 1995	International Conference on Sustainable Consumption and Production Patterns, Oslo, Norway.
Jul., 1995	OECD Workshop on "Clarifying the Concepts, Norway.
Aug. 31 - Sept. 1, 1995	Changing Consumption and Production Patterns Regional (Asia-Pacific) Workshop, Seoul, Korea.
Oct. 9-10, 1995	OECD's Labour/Management Program Workshop on Sustainable Consumption and the Role of the Social Partners, Paris.
1996	4th session of the UNCSD – Presentation of Sustainable Consumption and Production workplan.
1997	Conference on Greening Government, Hosted by Swiss Government.

ISO 14000 Information Sources for Canadians

- The Standards Council of Canada (SCC) offers an accreditation program for organizations registering EMSs to the ISO 14000 standards. Training and accreditation programs are also available for EMS auditors. For information contact Customer Services Information Division at the SCC at phone 1-613-238-3222, fax: 1-613-995-4564, or Email dwilson@scc.ca.
- Copies of the draft ISO 14000 EMS standards are now available through the SCC or the Canadian Standards Association (CSA). To purchase drafts, phone the SCC at 1-800-267-8220 or the CSA Standard Sales Group at 1-416-747-4044. Prices range from $40-$100 plus GST and shipping.
- ISO 14000 EMS standards are on the CSA website. Surf to the TC207 section of http://www.csa.ca/isotcs/iso207.html – from here you can get news, background information, reports, etc.

Info on the Net

ISO 14000 Infocentre	http://www.iso14000.com/ many ISO links, good starting point
Stroller ISO 14000 Information	http://www.stroller.com/iso.htm excellent site with links to related topics
MGMT Alliances Inc.	http://mindlink.net/mgmt/ includes link to a great homepage
ISO 14000 Q Links	http://www.quality.org/qc/html/iso14000.html links to related ISO 14000 sites, includes a directory
ISO 14000 Report	http://deming.eng.clemson.edu/pub/tqmbbs/iso900/iso14000.txt text-based report, loaded with information

Sustainable Production

continued from page 4

governments to secure commitments to action, including quantified objectives and monitoring; and

e) revises UN guidelines for consumer protection to incorporate sustainability considerations.

3. The World Business Council for Sustainable Development (WBCSD) working group on sustainable production and consumption will be merged with a similar working group on eco-efficiency and will focus on:

a) moving the debate from one which may present barriers and pressure for business to one of opportunity for business;

b) identifying strategies and frameworks that satisfy consumer demand and societal needs while promoting environmental quality;

c) guiding the agenda to avoid stifling competition, economic growth and technological innovation; and

d) highlighting business accomplishments, thereby providing business with a vehicle to shape policy.

4. The UNEP (United Nations Environment Program) Cleaner Production Program, although established prior to the Earth Summit, complements the sustainable consumption action plan outlined in Agenda 21. Program activities include:

a) developing a primer on life-cycle assessment;

b) establishing National Cleaner Production Centres;

c) conducting environmental impact assessments of major technology related decisions;

d) preparing a training kit on environmental management systems for small- and medium-sized businesses to help them implement ISO 14000 standards;

e) incorporating environmental issues into business school curricula; and

f) conducting cleaner production seminars in co-operation with the Wuppertal and Stockholm Institutes.

The scope of these ambitious work programs indicates that defining and implementing sustainable production and consumption will be a challenging and perhaps controversial task. However, it is encouraging to note that while bureaucrats and industrial associations struggle with definitions and concepts, many industries and political jurisdictions are charging ahead with policies and programs aimed at reducing the material content and environmental impacts of their activities.

electronics industry moves closer to LCA

WHILE THE ELECTRONIC INDUSTRY IS NOW USING SEVERAL DESIGN FOR ENVIRONMENT (DFE) TOOLS IN ORDER TO address product-related environmental issues, it has only recently begun to fully embrace the practice of Life-Cycle Assessment (LCA). One reason for the slow acceptance of LCA by this industry is the widely held belief that the inherent complexity of LCA makes it unsuitable to assess such complex products as computers. The fact that the most visible attempt to streamline the LCA methodology has come from a company manufacturing such complex products, namely AT&T, is evidence of this view.

However, two factors are gradually changing this view of LCA: (i) the understanding that LCA is a technique that can be applied successfully to a subset of electronic products and (ii) the availability of software and databases allowing practitioners to streamline the resource requirements of carrying out LCA without compromising the LCA methodology.

With regard to the first factor, the two words "Life-Cycle" as used in the LCA acronym convey the impression that such studies must always include the full life-cycle of entire products. The imperative of an LCA is that the environmental and resource consequences of a product or process decision be studied comprehensively. This means being alert to trade-offs among environmental flows (e.g., solid waste reduction at the expense of air emissions), and among interconnected processes (e.g., energy savings during usage at the expense of raw materials processing).

Within this imperative, properly applied LCA requires a well-considered focus upon particular life-cycle phases being influenced by the product or process decision at hand (e.g., end-of-life), as well as upon the particular components within an integrated product (e.g., monitor housing). The purpose of the all-important scoping phase of an LCA is to define the boundaries of the studied system so that affected processes, and only affected processes, are studied. The LCA technique can therefore be applied to discrete electronic components or technologies.

Some of the most recent published examples include:

Components:

- monitor and computer housing (IBM);
- capacitors (IVF in Sweden);
- lead-free or reduced-lead solders (Ford US and ABB, Ericsson in Sweden);
- fibre optic cables (Nokia); and
- supplies for computer peripherals (Hewlett-Packard).

Technologies/Processes:

- EMC shielding technologies (IBM); and
- product end-of-life alternatives (IBM, Electronic Industries Association, and the Nordic Council).

These projects often involved an external research institution or LCA firm such as the Swedish Institute of Production Engineering Research and Ecobalance in the United States.

The second main factor driving the growing acceptance of LCA as a practical DFE tool is the increasing availability of powerful LCA software and databases. Providing comprehensive and well documented LCI (life-cycle inventory) databases is a necessity in order to improve the efficiency and affordability of comprehensive LCA. Recent LCA models like the TEAM model (Tools for Environmental Analysis and Management) have broadened the coverage of LCI databases (which traditionally focused on packaging materials) to integrate electronic processes and products. Due to the complexity of electronic products, powerful calculation engines are also needed in order to handle the complex network flow modelling.

In a recent LCA project carried out by Ecobalance for Hewlett-Packard (HP), the total number of linked processes was greater than 1 100. This represented 99.6% of the total inputs consumed in the product manufacturing as well as capital equipment and employee commuting. Even though the project involved primary data collection at several HP locations and at more than seven major suppliers, the project was completed in

continued on page 7

Electronics Industry Moves Closer to LCA

continued from page 6

six months. Furthermore, the database compiled now allows full LCAs of similar products to be done in less than two months, bringing it well into the range of the product development time cycle.

This computer-aided streamlining of LCA resource requirements is now replacing approaches aimed at streamlining of the LCA methodology. The central strength of LCA is its comprehensiveness, that is, the wide scope of processes and environmental flows taken into account. Therefore, the LCA methodology should remain as rigorous in all cases in order to provide an unbiased assessment of complex systems.

Gradually, the electronic industry is embracing the concept of LCA, having started with relatively simple parts and progressively analysing more complex processes like silicon wafer production and integrated circuit processing. In this regard, the electronic industry is following the same path as the automotive industry. Moreover, both industries design and produce highly complex products (there are over 20 000 parts in a car), both outsource a significant share of the manufacturing (rendering more complex the data collection phase) and both have to take into account significant environmental burdens associated with the product usage phase, and design their products accordingly. LCA now has a proven history of beneficial use in the automotive industry and is doing the same for the electronic industry. ●

By Remi Coulon, Ecobalance Inc.

France Set to Issue LCA Standards in '96

FRENCH INDUSTRY NEEDS A NATIONAL LCA STANDARD AS SOON AS POSSIBLE, SAYS Pascal Poupet of AFNOR. And the French standards organization plans to issue a national standard in early 1996 after concluding field tests with several experimental LCA approaches.

For more information telephone: Pascal Poupet, AFNOR, +33 1 4291 5555

Environmental Performance Index

continued from page 3

Index provides a single rating for the company, thus interpreting and translating a large volume of data into a single measure of performance understandable by specialists and non-specialists alike.

The score is developed through a consistent analysis of company-wide data, which takes into consideration the environmental impact of the company operations as well as the progress made toward the company's goals. The use of a standard analysis allows year-to-year comparisons of performance while avoiding differing subjective judgments.

The Index takes into account 25 performance parameters in four categories: environmental releases, resource consumption, environmental remediation, and compliance. The performance parameters included in the Index are organised in a structure that provides performance measures for the four categories of performance parameters and their subcategories. The categories and subcategories generally correspond to environmental programs commonly found in companies. Thus, the Index structure provides managers with a way to target specific programs for improvement.

Scores are calculated by first evaluating performance in each of the parameters against a set of benchmarks. Positive and negative "raw scores" are awarded for each parameter, depending on how favourably or unfavourably the company's performance compares with the benchmarks. These raw scores are then weighted based on the relative importance of four key factors: impact on the environment, financial and public image risk to company, amount of control the company has over the parameter, and how directly the parameter measures environmental performance.

Lastly, the weighted scores for all parameters are added together for a final score which can be compared to a benchmark score.

For more information, contact: Arthur D. Little of Canada at 1-416-361-1051, in the United States at 1-617-498-5777 or in Belgium +32 2 762 0731 ext. 386.

Abstracted from "The Environmental Performance Index" by Stephen Poltorzycki, Arthur D. Little, Inc.

environmental product development in Australia

AUSTRALIA IS A RELATIVE NEWCOMER TO THE WORLD OF ENVIRONMENTALLY ORIENTED PRODUCT DEVELOPMENT and life-cycle assessment (LCA). Although some activity is taking place within universities and a handful of environmental consultancies, Australian industry has yet to acknowledge the environmental or economic significance of life-cycle thinking. Some exceptions do exist with large resource-based companies exploring LCA's potential in process design, strategic planning and marketing.

A recent workshop on Environmental Design Tools held at the Royal Melbourne Institute of Technology's (RMIT) Centre for Design, was probably the first time people from a range of sectors, including large manufacturers, universities, government and environmental consultancies, gathered to discuss LCA activity in Australia. The workshop explored the current uses of LCA, as well as its benefits, flaws and likely future directions. More qualitative tools to evaluate the environmental impacts of products and materials were also debated. Overall the workshop demonstrated that more work needs to be done to strengthen the profile of LCA in Australia.

Sharing data

A critical issue for LCA development in Australia is the need for accurate local data. Unlike Europe and North America, where substantial amounts of data are published on inputs and outputs, Australian companies are reluctant to make such data available fearing that commercially sensitive information could be exposed. A vital step toward addressing this issue is being pursued by the Co-operative Research Centre (CRC) for Waste Management and Pollution Prevention based at the University of New South Wales. The CRC project will build on existing Australian knowledge and collect inventory data on selected materials commonly used by industry.

Several other initiatives also indicate that LCA and environmentally oriented product development is gathering momentum in Australia.

EcoReDesign

Probably one of the most exciting initiatives is the EcoReDesign(tm) Program. This national demonstration initiative, developed and implemented by the Centre for Design at RMIT, is aimed at assisting companies to improve the environmental performance of manufactured products.

Based on a life-cycle approach, EcoReDesign mixes the skills and expertise of industry and research institutions. Interdisciplinary teams of designers, engineers, environmental experts, social scientists and marketers work with individual companies and in-house personnel to introduce and integrate critical environmental considerations into the companies' conventional design process.

Scheduled to finish in late 1996, the specific outcomes will include a series of `greener' consumer and commercial products (e.g. electric kettles, dishwashers, packaging, water efficient taps, office furniture), and a detailed information kit.

The EcoReDesign Kit will document the products and processes and demonstrate to other companies how they might commence their own environmental design exercise. The Kit will contain a short motivational video for senior managers highlighting the product case-studies and explaining the fundamentals of LCA, alternative environmental design tools, and how to gain competitive advantage through design.

The other key component of the Kit will be an introductory "How To" guide with information about LCA and other environmental design strategies such as design for disassembly and recycling, producer responsibility, cleaner production, etc. Information about where to find additional expertise,

continued on page 9

Environmental Product Development in Australia

continued from page 8

consultants and relevant publications will also be included.

Federal Funding

The Environment Protection Agency, which funds EcoReDesign, is the Australian Government's most active vehicle for supporting work in the area of LCA and environmentally oriented product development. They are also supporting another major demonstration initiative on Cleaner Production, and like EcoReDesign it will culminate in practical case-studies and an information kit.

Limited resources

With the exception of the Royal Australian Institute of Architects and the Institution of Engineers, mainstream professional design organisations have been very slow to recognize the importance of environmental considerations. In contrast, two smaller non-conformist groups have led the charge in advocating environmentally responsible design. The Society for Responsible Design and the Ecodesign Foundation have in their own individual ways promoted a `cradle-to-grave' ethic to their members through publications and exhibitions. Their efforts are constrained by a lack of resources resulting in much discussion and only nominal real-life application.

Consumer awareness

Environment and conservation groups have also been highlighting the need for industry to adopt LCA as mainstream practice, however, their activity is limited to pressuring industry and government. The most active community-based group has been the Australian Consumers' Association (ACA). Through their own publications and research projects, the ACA has consistently been raising consumer awareness about LCA and discussing an often complex concept in more understandable terms.

The Future

Overall the future of environmentally oriented product development (and LCA) looks optimistic. However, Australian industry needs to shift into a more progressive and non-reactive mode of operation if any notion of sustainability is to be achieved `down under'.

For more information about the EcoReDesign(tm) Program and associated program newsletter contact:

John Gertsakis - Project Manager
Centre for Design at RMIT
Royal Melbourne Institute of Technology
GPO Box 2476V, Melbourne 3001, Australia
Telephone: +61 3 96603902
Fax: +61 3 96393412
Email: gertsakis@rmit.edu.au
URL: http://www.cfd.rmit.edu.au

By John Gertsakis

Environmentally Conscious Design and Manufacturing

Abstracts of articles from the International Journal of Environmentally Conscious Design and Manufacturing (ECDM) are available on line at:

http://ie.uwindsor.ca/ecdm/journal/ courtesy of Andrew Spicer of the ECDM lab, University of Windsor, Canada.

Upcoming ECDM Conference...

The 4th International Congress on Environmentally Conscious Design and Manufacturing (ECDM), July 23 - 25, 1996, in Cleveland, Ohio, will cover Life Cycle Assessment; Design for Environment; ECDM Cost/ Benefit Analysis; Ecofactories; Environmentally Conscious Chemical Manufacturing; Machining; Finishing; Process Simulation and Modelling; Recycling and Reuse and much more.

For information, contact:

Jeff Weinrach, Benchmark
Environmental Corp.
4501 Indian School Rd. NE, Suite 105, Albuquerque, NM 87110
Phone: 1-505-262-2694 Fax: 1-505-262-2698
Email: jbweinrach@aol.com

taking the natural step

WHAT IF A NATION'S SCIENTISTS COULD ACHIEVE CONSENSUS ON THE FUNDAMENTAL PRINCIPLES OF SUSTAINABILITY AS A BASIS FOR DECISION-MAKING BY SOCIETY? What if the scientists who reached this consensus actively engaged citizens, corporations and organizations in the implementation of those principles? This improbable scenario has occurred in Sweden and it is called *The Natural Step*.

Founded by Swedish scientist and oncologist Dr. Karl-Henrik Robèrt, The Natural Step began with the idea that too much effort and scientific debate on the environment was focused on disputes rather than on areas of agreement. Dr. Robèrt developed a consensus paper (after 21 drafts) on four basic system conditions for sustainability.

1. **Substances from the earth's crust must not systematically increase in nature.**
   This means that fossil fuels, metals and other minerals must not be extracted at a faster pace than their slow redeposit into the earth's crust.
2. **Substances produced by society must not systematically increase in nature.**
   This means that substances must not be produced at a faster pace than they can be broken down in nature or deposited into the earth's crust.
3. **The physical basis for the productivity and diversity of nature must not be systematically deteriorated.**
   This means the productive surfaces of nature must not be diminished in quality or quantity and we must not harvest more from nature than can be created.
4. **Just and efficient use of energy and resources.**
   This means basic human needs must be met with the most resource efficient methods possible, including just resource distribution.

Once agreed to, the next move was to help companies and individuals incorporate the conditions for sustainability into their planning and decision-making processes. For corporations this means recognizing that the principles or system conditions are a reality and then using them as guide for long-term investment and strategic planning.

Proponents of The Natural Step promote their approach on the basis of its potential financial rewards. Introductory presentations have titles such as, *Investing for Tomorrow's Market*. The message is that the system conditions are a wall that every business will come up against and those that see the wall coming will be in a better strategic position.

To promote it's message The Natural Step has established a foundation which initiates and supports networks of professionals including scientists, business leaders, engineers, artists, architects, agriculturalists, teachers, environmental activists, nurses and lawyers. Other activities include a mass mailing of training material to every household in Sweden, annual environmental awards to companies that take bold and visionary decisions and a training program for businesses and local authorities in ecological systems thinking.

The Natural Step has been adopted and applied in 49 municipal authorities and in 29 Swedish corporations. Successful examples include IKEA, which produces a line of furniture containing no metal or non-biodegradable glues and is now educating 25 000 employees world-wide. ICA, a major supermarket chain and user of refrigerators, began a dialogue with Electrolux that resulted in the redesign of coolant technology to eliminate chlorinated compounds.

The Natural Step has also been established in the United States, New Zealand, Australia, the United Kingdom, The Netherlands, Norway and Denmark.

For more information contact:
The Natural Step
Amiralitetshuset, Skeppsholmen,
S 111 49 Stockholm, Sweden
Telephone: +46 8 678 00 22
Fax: +46 8 611 73 11

WHERE A COMPARATIVE ASSERTION IS BEING MADE, LIFE-CYCLE CRITICAL REVIEW IS A REQUIREMENT IN THE CURRENT draft standards for Life-Cycle Assessment, issued by the International Organization for Standardization (ISO).

benefits of critical review in life-cycle studies

Although LCA offers significant potential benefits to companies for improving the environmental performance of a product system, there is still considerable controversy regarding its use in comparative studies. For example, one LCA study may conclude that Product A is environmentally superior to Product B, while another LCA study finds the opposite to be true.

The primary goals of a critical review are to provide an independent evaluation of the life-cycle inventory (LCI) methodology, and to provide input to the study proponents on how to improve the quality and transparency of the study — whether the intended use of the study is comparative or not. It was for these reasons that three aluminum producers were the first to apply a three-stage review process to an LCI study.

In 1991, Alcan Aluminum Ltd., the Aluminum Company of America, and Reynolds Metals Company decided to jointly conduct an LCI on the North American aluminum beverage can. The purpose was to provide a detailed inventory that would serve as a baseline for improvements and to provide a definitive outline of the most current performance in aluminum beverage can production (aluminum production, can manufacturing, can filling, recycling and disposal). An independent expert panel reviewed the study.

The study cost approximately $250 000 (U.S.), including $30 000 (U.S.) for the independent expert review panel activities. Data collection activities at the operating plants averaged about three person-days per reporting location. By the conclusion of the study, there were over 500 000 data points including data collected from over 60 sites in six countries and four continents.

The Peer Review Process

The primary goal of the three-stage review process was to provide an independent evaluation of the LCI methodology.

Stage 1: Review of the study purpose, boundaries, and data categories.

Objectives: to ensure the purpose of the study was clearly defined; to ensure that data categories included in and excluded from the system boundary were identified; and to understand how the results of the study would be used.

Stage 2: A mid-project review after data was collected and normalized.

Objectives: to review the responses to Stage 1 recommendations; to confirm the categories to be included in the study; to verify the adequacy of the data collection procedures and the data quality assessment; and to verify the data integration model.

Stage 3: Review the draft final report.

Objectives: to review the responses to Stage 2 recommendations; to confirm that the results are consistent with the stated purpose; to assess the data quality specifications relevant to the stated purpose; to ensure transparency of the methodology; and to ensure that the limitations of the use of the study results (in relation to scope and data quality) are clearly communicated.

Benefits of the Review Process

The peer review process provided precise instruction in numerous situations in which the documented approaches found in the reference materials could not possibly offer such practical inputs. Most significant were advances in four main areas; system boundaries (determining the inclusion of ancillary material flows); data quality assessment; sensitivity analysis; and process improvement analysis (setting priorities).

A scoping exercise helped the study group understand which inputs and outputs of the product system were most significant. This exercise defined the cumulative contribution of ancillary materials to the product system and prevented valuable resources being spent on insignificant inputs and outputs. This scoping exercise also provided a foundation for comparisons to other life-cycle studies on the

continued on page 12

Benefits of Critical Review in Life-Cycle Studies

continued from page 11

aluminium beverage can system. It highlighted, for example, that ancillary material flows represent over 20% of the system material and energy flows and a corresponding level for environmental emissions.

The review process also identified the need to measure the quality, both quantitatively and qualitatively, of the data collection processes and the data itself. Such measures provided confidence to the study team, that the data inputs truly represented the system being modelled.

Quantitative measures helped the study team develop various sensitivity analyses that examined the effect of data uncertainty on the system results. Most life-cycle studies report single values for the data categories and are often misleading due to variability in performance between locations and over time. Traditional sensitivity analyses varied the result for one independent variable while holding other variables constant. Even with the advent of computer processing such exercises are very cumbersome and are often not completed. In the aluminium can study, with an estimated 800 independent variables, a new procedure was developed to identify the most significant variables.

With the range of opportunities presented by the sensitivity analysis, the participating companies still had a significant task in identifying where to focus their improvement efforts. The study team developed a procedure to set priorities and define the most promising process improvement potentials.

The study concluded that in the context of LCA, peer review or "critical review" does improve quality and transparency of an LCA study, as highlighted in the aluminium beverage can example. ●

Abstracted from "Life-cycle Critical Review! Does it Work?" by James Fava (Roy F. Weston Inc.) and Steven Pomper (Alcan Aluminum Ltd.) Presented at SAE Total Life-Cycle Conference and Exposition, Oct. 15-16, 1995

OOPS! Correction!

We apologise for the error concerning contact information for a new book on the ISO 14000 series profiled on pg. 6 of the last issue. To order the book entitled ISO 14000 – *A Guide to the New Environmental Management Standards*, by Tom Tibor and Ira Feldman, call:

Canada: 1-416-293-8141 ext. 340
United States: 1-800-634-3966
Other Countries: 1-708-789-4000 ext. 5466

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